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ABSTRACTS OF THE PROCEEDINGS

OF THE

GEOLOGICAL SOCIETY OF LONDON.

No. 271.] [Session 1872–73.

June 25, 1873.—Joseph Prestwich, Esq., F.R.S., Vice-President, in the Chair.

Thomas Douglas, Esq., West Lodge, Crook, Darlington; Joseph Mitchell, Jun., Esq., Wasbro' Dale, near Barnsley; Ralph Botley, Esq., of Hindley, near Wigan; Daniel Ruddle, Esq., 60 Delancy Street, N.W.; John Dunning, Esq., C.E., Middlesbrough; Thomas Stephens, Esq., M.A., Hobart Town, Tasmania; and James Willis, Esq., Government Inspector of Mines, Durham, were elected Fellows of the Society.

The following communications were read:—

1. "On six Lake-basins in Argyllshire." By His Grace the Duke of Argyll, K.T., F.R.S., President.

The author referred to the part ascribed to glacial action in the formation of lake-basins, and described the basins of six lakes in Argyllshire, the characters presented by which seemed to him inconsistent with their having been excavated by ice. Among these lakes were Loch Fyne, Loch Awe, Loch Leckan, and the Dhu Loch. The upper part of Loch Fyne was said to be cut off from the rest by a bar of islands, with only one or two deeper passages. The country about Loch Fyne was described as consisting of Upper and Lower Silurian mica-slates, which have been violently contorted, their normal strike being indicated by the direction of the valleys. Loch Fyne occupies a niche in the slope of the rocks, having an escarpment on one side and the shelving strata on the other. The existence of a fault along the line of the loch was probable, but could not easily be ascertained. Its greatest depth in this part was said to be 84 fathoms. Its banks show marks of glaciation, whereon the surface is well adapted for their preservation; the strongest marks are on those rock-faces which look up the loch. Between Loch Fyne and Loch Awe the mica-slates are interstratified with granite, which the author believed to have been forced up between the plains of stratification by the pressure caused by the falling in of the mica-slates, as fragments of the latter rock are imbedded in the granite. The author described the different structure of the two banks of Loch Awe, the upper part of which seemed to him to lie in a synclinal trough; and its waters were only prevented by a low col from finding their way to the Atlantic in this direction, instead of from the lower end. The formation of the basin of Loch Awe seemed to the author to be due solely to geological structure, as was also the case with another lake beyond the head of Loch Awe. The surrounding country was said to be full of smaller lake-basins, the formation of which might be due to the denudation of the softer mica-schists lying below the granite ridges, but in some cases the basins were excavated in the latter. Loch Leckan was mentioned as an example. It is about a mile long, from 100 to 200 yards broad, and no less than 18 fathoms deep. At the top of its southern bank, which consists of granite, there is another lake (Loch-na-Craig), about 200 yards broad and 9 fathoms deep. The surrounding hills are low, and there appeared to be no source which could furnish ice to excavate a lake of such depth as Loch Leckan; and further, the author contended that if one of these two basins were excavated by ice, the other could hardly have been preserved intact. Two other lakes, excavated on the summits of granite ridges, were mentioned; and the author could not conceive how either a glacier or an ice-cap could have produced such basins. The Dhu Loch, separated from Loch Fyne by a bank of gravel about a mile broad, is entirely in detrital matter, which the author thought might have been accumulated in its present form by the sea beating against the end of a glacier. From its position and level, the Dhu Loch rises and falls with the tide; and it would appear that it formerly extended some miles further up the valley, where the author had found clays containing a mixture of marine and freshwater Diatomaceæ. In five of these cases the author thought it was impossible that the basins are due to glacial action.

Discussion.

Prof. Ramsay dissented from the concluding parts of His Grace's remarks, which might lead his hearers to suppose that he had attributed all lake-basins, without exception, to glacial action. On the contrary, he had in all cases maintained that they were due in many instances to certain original valleys, due to various agencies, both of superficial denudation and of internal disturbance, and acting at all periods of the earth's existence. These earlier inequalities had indeed received their final configuration from the action of ice; and it was only certain of the more shallow basins to which he assigned a purely glacial origin. He disclaimed any such ideas, which he regarded as utterly irreconcilable with the phenomena of nature. As to the sides of the basins, he had had great experience, and nowhere had he seen a case in which he could regard the existence of a lake as merely due to a fracture of the rocks. In Scotland it was well known that most of the contortions of the rocks had taken place before the deposition of the Old Red Sandstone. He wished to know whether during the ages that had passed since that time all atmospheric agencies had been suspended. On the contrary, their operation had been such that thousands and thousands of feet of strata had by their means been removed. Nowhere was this more evident than in considering the structure of the carboniferous areas.

where enormous denudation had taken place long before even the coal had been deposited. How then could we ignore this operation in other parts of the country? As to faults, he submitted that their existence must be proved rather than assumed. Did they exist, they were not gaping faults, but closed; and he regarded it as physically impossible for such hollows as those in which the lakes were found to be due to such causes. Even if fractures existed, they would not remove the matter of which the rocks were composed. They might, however, constitute lines of weakness, along which denuding agents might more readily work. As to the lakes on the summits of ridges, he would not pretend to account for what he had not seen; but he cited similar lakes in the Grimsel, which presented similar phenomena, and which he regarded as undoubtedly due to glacier action. Even on the top of *roches moutonnées* such basins were found; and though he might not know the exact circumstances under which they were found, they were undoubtedly due to ice-action. If in Switzerland and other glaciated countries of the present day we found the configuration of the country presenting similar phenomena to those of Scotland, he considered that there was ample ground for attributing both to the same cause, and there was no need of invoking other causes. It was moreover to be borne in mind that though similar contorted gneissose rocks to those of Scotland occurred in several other countries, it was only in those which had been glaciated that such numerous lake-basins were to be seen.

The Duke of Argyll, in reply, agreed with Prof. Ramsay that it was not in all cases that the lake-basins were due to disturbance of the rocks; and indeed in some of the most contorted districts lakes were rarely present. All his contention was that whatever may have been the denuding agent, it was not in all cases ice.

2. "Description of the Skull of a dentigerous Bird (*Odontopteryx toliapicus*, Owen), from the London Clay of Sheppey." By Prof. Richard Owen, F.R.S., F.G.S.

The specimen described by the author consisted of the brain-case, with the basal portion of both jaws. The author described in detail the structure and relations of the various bones composing this skull, which is rendered especially remarkable by the denticulation of the alveolar margins of the jaws, to which its generic appellation refers. The denticulations, which are intrinsic parts of the bone bearing them, are of two sizes,—the smaller ones about half a line in length, the larger ones from two to three lines. The latter are separated by intervals of about half an inch, each of which is occupied by several of the smaller denticles. All the denticles are of a triangular or compressed conical form, the larger ones resembling laniaries. Sections of the denticles show under the microscope the unmistakable characters of avian bone. The length of the skull behind the fronto-nasal suture is 2 inches 5 lines; and from the proportions of the fragment of the upper mandible preserved, the author concluded that the total length of the perfect skull could not be less than between 5 and 6 inches. The author proceeded to compare the fossil, which he declared to present strictly avian characters, with those groups of birds in which the beak is longer than the true cranium, a character which occurs as a rule in the *Aves aquaticæ.* He stated that none of the Waders have the nostrils so remote from the orbits as in *Odontopteryx*; and this character, with the absence of the superorbital gland-pit, limits the comparison to the Totipalmates and Lamellirostrals. The former are excluded by their not having the orbit bounded by a hind wall as in *Odontopteryx,* and in this and other peculiarities the fossil seems to approach most nearly to the Anatidæ, in the near allies of which, the Goosanders and Mergansers, the beak is furnished with strong pointed denticulations. In these, however, the tooth-like processes belong to the horny bill only, and the author stated that the production of the alveolar margin into bony teeth is peculiar, so far as he knows, to *Odontopteryx.* He concluded, from the consideration of all its characters, "that *Odontopteryx* was a warm-blooded, feathered biped, with wings; and further, that it was web-footed and a fish-eater, and that in the catching of its slippery prey it was assisted by this pterosauroid armature of its jaws." In conclusion, the author indicated the characters separating *Odontopteryx* from the Cretaceous fossil skull lately described by Prof. O. C. Marsh, and which he affirms to have small, similar teeth implanted in distinct sockets.

Discussion.

Mr. Seeley had given much study to the Pterosaurians, to which the author had indicated the affinities of *Odontopteryx.* He had in *Ornithocheirus Oweni* found what appeared to be identical structure with that of the bird, and it therefore appeared to form a new genus of Pterosaurians. Both in the frontal and occipital regions of the skull he recognized affinities to *Ornithocheirus*; but it presented even more distinctly marked reptilian affinities. The position of the brain was also quite as far back in the skull, and the quadrate bone also presented curious analogies, so much so as to be almost identical. The sutures presented characters similar to those exhibited by immature birds; and he thought that the separation of the bones in this example showed affinities to the anserine type. He was quite prepared to regard the fossil as that of a bird rather than of an Ornithosaurian. He inquired as to the character of the palatal bones.

Mr. Charlesworth inquired as to the light in which this discovery would be regarded by evolutionists.

Prof. Owen briefly replied.

3. "Contribution to the Anatomy of *Hypsilophodon Foxii,* an Account of some recently acquired Remains of this Dinosaur." By J. W. Hulke, Esq., F.R.S., F.G.S.

After referring to Professors Owen and Huxley's descriptions of the Mantell-Bowerbank skeleton in the British Museum, and to the paper by the last-named gentleman on the skull of this Dinosaur read at a meeting of this Society in 1870, the author communicated details of its dentition, the form of its mandible, and that of the cones of the shoulder and fore limb, and of the haunch and hind limb, hitherto imperfectly or quite unknown. The resemblance to *Iguanodon* is greater than had been supposed, but the generic distinctness of *Hypsilophodon* holds good.

DISCUSSION.

Prof. OWEN remarked that palæontologists generally were interested in obtaining such additional evidence of the generic characters of *Iguanodon* as Mr. Fox's valuable discovery of the skull and other remains of the small species in the Isle of Wight Wealden might supply; but such desirable information, especially as regards the cranial structure of the herbivorous Dinosaurs, is shut out if those remains are shown to belong to a distinct genus. In the paper to that end in the 'Quarterly Journal' for 1870, p. 3, the only teeth of the so-called *Hypsilodon* known to the writer, were those of the upper jaw, and these were not entire; the portion of crown answering to the serrated portion in *Iguanodon* was worn away. Mr. Fox was therefore justified in rejecting Prof. Huxley's genus *Hypsilophodon*, although he might believe the statement that such serrations were characteristic of the teeth of *Iguanodon*, especially when emphasized by the phrase "so characteristic;" the fact being, however, that marginal serrations characterize the apical half of the crown in the Dinosaurian genera *Scelidosaurus* and *Echinodon* as in *Iguanodon*. What are truly characteristic of the upper molars of that herbivorous Dinosaurian are the ridges on the outer surface of the crown, which ridges, being also present in Fox's *Iguanodon*, and supposed to be peculiar thereto, suggested to Prof. Huxley the term *Hypsilophodon*. But the lower molars of *Iguanodon* are equally ridged, but on the opposite side to those above, viz. the inner side; and the marginal serrations extend nearer to the base of the crown. Now the lower molars of the small *Iguanodon*, also found, with the mandible, by Mr. Fox, show this generic character, and vindicate the taxonomy of their discoverer. We may rest assured, therefore, that the sloping edentulous symphysial part of the mandible of the great *Iguanodon* had a downbent edentulous part of the premaxillaries applied to it, such as the fore part of the skull of *Iguanodon Foxii* exhibits. Without a knowledge of the characters of both upper and lower molars of this small *Iguanodon*, no one in quest of the truth of the matter could affirm "that the teeth of this reptile were perfectly distinct from those of *Iguanodon Mantelli*." In the last plate of Prof. Owen's 'Monograph' for the forthcoming volume of the Palæontographical Society, the mandible and mandibular teeth are figured, and he had hoped to have received a proof to show to the meeting. The mandibular teeth exhibited by Mr. Hulke were identical with those previously discovered by Mr. Fox. In the 'Monographs' the evidence will be found of the specific, but not generic distinction of Mr. Fox's small Dinosaur from the large *Iguanodon Mantelli*.

4. "On the Glacial Phenomena of the 'Long Island,' or Outer Hebrides." By James Geikie, Esq., F.R.S.E., F.G.S., of H.M. Geological Survey of Scotland.—First paper.

The author commenced by describing the physical features of Lewis, which he stated to be broken and mountainous in the south, whilst the north might be described as a great peat moss rising gradually to a height of about 400 feet, but with the rock breaking through here and there, and sometimes reaching a higher elevation. The north-east and north-west coasts are comparatively unbroken, but south of Aird Laimisheadar in the west and Stornoway in the east, many inlets run far into the country. The island contains a great number of lakes of various sizes, which are most abundant in the southern mountain tract and in the undulating ground at its base. The greater part of Lewis consists of gneiss, the only other rocks met with being granite and red sandstone, and conglomerate of Cambrian age. The stratification of the gneissic rocks is generally well-marked; the prevalent strike is N.E. and S.W. with S.E. dip, generally at a high angle. The author described in considerable detail the traces of glaciation observed in the lower northern part of Lewis, and inferred from his observations that the ice passed from sea to sea across the whole breadth of this district, and that it not only did not come from the mountainous tract to the south, but must have been of sufficient thickness to keep on its course towards the north-west undisturbed by the pressure of the glacier masses which must at the same time have filled the glens and valleys of that mountain-region. After describing the characters presented by the bottom-till in the northern part of Lewis, the author proceeded to notice those of the lakes, some of which trend north-west and south-east, others north-east and south-west, whilst those of the mountain district follow no particular direction. The lake-basins of the first series he regarded as formed at the same time and by the same agency as the *roches moutonnées* and other marks of glacial action; they are true rock-basins or hollows between parallel banks formed wholly of till, or of till and rock. The N.E. and S.W. lakes coincide in direction precisely with the strike of the gneiss; and the author explained their origin by the deposition of till by the land-ice in passing over the escarpments of the gneiss facing the north-west. The lakes of the mountain district are regarded by the author as all produced by glacial erosion. The author considered that the ice which passed over the northern part of Lewis could only have come from the main land. Referring to the glaciation of Raasay, he showed that the ice-sheet which effected it must have had in the Inner Sound a depth of at least 2700 feet, and taking this as approximately the thickness of the *mer de glace*, which flowed into the Minch, which is only between 50 and 60 fathoms in depth, no part of this ice could have floated, and the mass must have pressed on over the sea-bottom just as if it had been a land surface. Ice coming from Sutherland must have prevented the flow of the Ross-shire ice through the Minch into the North Atlantic, and forced it over the low northern part of Lewis; and the height to which Lewis has been glaciated seems to show that the great ice-sheet continued its progress until it reached the edge of the 100-fathom plateau, 40 or 50 miles beyond the Outer Hebrides, and then gave off its icebergs in the deep waters of the Atlantic.

DISCUSSION.

Prof. OWEN corroborated the author's views as to the grand marks of glaciation on the island of Lewis which had come under his personal observation.

5. "Notes on the Glacial Phenomena of the Hebrides." By J. F. Campbell, Esq., F.G.S.

This communication consisted of notes extracted from the author's journal, giving his observations of indications of glacial action in various islands of the group of the Hebrides. Heynish in Tiree is 500 feet high, and has many large perched blocks on its top. These blocks are of gneiss, and the author thought they came from the north-west. The Barra islands are described as rocky, and resembling the hill-tops of a submerged land. All ice-marks found by the author seemed to him to come from the north and west. He thought that the final grinding was given by floating ice when the land was more submerged than at present. At Castle Bay, in Barra, the author observed well-preserved glacial striæ at the sea-level in a direction from N.N.W. The whole island is glaciated and strewn with perched blocks. Glacial indications were also observed in South Uist, Beuberula, and Skye; and the author stated that, on the whole, he was inclined to think that the last glacial period was marine, and that heavy ice came in from the ocean, the local conditions being like those of Labrador. The author regarded most of the lake-basins of the Hebrides as formed by ice-action, and considered that the ice by which those islands were glaciated came from Greenland.

6. "On Fossil Corals from the Eocene Formation of the West Indies." By Prof. P. Martin Duncan, M.B., F.R.S., V.P.G.S.

The author had considered his labours amongst the fossil corals of the West Indian Islands finished, but lately a very fine collection has been sent to him from the University of Upsala, and Mr. P. T. Cleve of Stockholm. The specimens were collected from limestone and coral conglomerates, which are covered by, and rest upon volcanic débris and ejectamenta in the island of St. Bartholomew. The species represented there are numerous, and may be divided into:—Group 1, species not hitherto known; 2, species with a Cretaceous facies; 3, species characteristic of the horizons of the Upper Eocene and Oligocene deposits of Europe; 4, species found also in the Nummulitic deposits of Europe and Sinde; 5, species belonging to the recent coral fauna; 6, species belonging to genera which belong to the Jurassic fauna, and to the Caribbean.

The determination of the forms of the associated Mollusca and Echinodermata permit the following deposits being placed on a general geological horizon,—the limestone and conglomerate of St. Bartholomew, the dark shales beneath the Miocene of Jamaica, the beds of San Fernando, Trinidad. These were probably contemporaneous with the Java deposits, the Eocene of the Hala chain, the great reefs of the Castel Gomberto district, the reefs of Oberberg in Steiermark, and the Oligocene of Western Europe.

The author has already described reef corals from the Lower Cretaceous (Upper Greensand) of Jamaica; and the size of the specimens proves that the reef was exposed to the surf of an open sea. To these reefs succeeded on the same area others in the Eocene time, in the Miocene and Pliocene; and there are modern reefs in the neighbourhood.

The affinities and identities of the fossil forms with those of contemporaneous reefs in Asia and Europe, and the limitation of the species of the existing Caribbean coral fauna, point out the correctness of the views put forth by S. P. Woodward, Carrick Moore, and the author, concerning the upheaval of the isthmus of Panama after the termination of the Miocene period.

7. "Note on the Lignite-deposit of Lal-Lal, Victoria, Australia." By R. Etheridge, Esq., Jun., F.G.S.

The author described this deposit, which is worked at the village of Lal-Lal, south of Mount Bunniyong. A boring towards the centre of the deposit showed about 73 feet of sand, clay, and gravel, 3 feet of fireclay, and 115 feet of lignite. The lignite is an earthy bituminous coal, composed of branches, roots, &c. of coniferous trees. In the mass there are a few thin seams of jet and clay-beds, accompanied by two kinds of resin. The lignite is very poor in carbon. It is almost entirely composod of remains of coniferous plants not now existing in Victoria; and the author considered that it is nearly of the same age as the Lignite deposit of Morrison's Diggings, which has been regarded as Miocene.

The following specimens were exhibited:—

Specimens of *Oreaster bulbiformis*, from the Upper Chalk, Bromley, Kent; exhibited by Henry Woodward, Esq., F.R.S., F.G.S.

Specimens of *Hypsilophodon Foxii*; exhibited by J. W. Hulke, Esq., F.R.S., F.G.S., in illustration of his paper.

Leg-bones of *Dinornis maximus*, Canterbury Plains, New Zealand, the property of Lieut.-Col. Michael; exhibited by Mr. Charlesworth.

Three Rostra of Xiphioid Whales, from the Suffolk Red Crag, originally in the Acton Collection; exhibited by Mr. Charlesworth.

Casts and Photographs of the "Stewart" Diamond, from South Africa; exhibited by Prof. Tennant.

The next Meeting of the Society will be held on Wednesday, November 5, 1873.